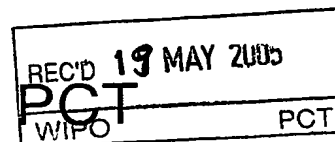


# PATENT COOPERATION TREATY

From the  
INTERNATIONAL SEARCHING AUTHORITY



To:

see form PCT/ISA/220

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY  
(PCT Rule 43bis.1)

Date of mailing  
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference  
see form PCT/ISA/220

**FOR FURTHER ACTION**  
See paragraph 2 below

International application No.  
PCT/GB2005/000114

International filing date (day/month/year)  
17.01.2005

Priority date (day/month/year)  
17.01.2004

International Patent Classification (IPC) or both national classification and IPC  
B01J19/00, B01D3/08, B01F13/00

Applicant  
THE UNIVERSITY OF SHEFFIELD

**1. This opinion contains indications relating to the following items:**

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☒ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

**2. FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1b/s(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

**3. For further details, see notes to Form PCT/ISA/220.**

Name and mailing address of the ISA:



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**WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY**

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**Box No. I Basis of the opinion**

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1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
  - ☐ This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
  - a. type of material:
    - ☐ a sequence listing
    - ☐ table(s) related to the sequence listing
  - b. format of material:
    - ☐ in written format
    - ☐ in computer readable form
  - c. time of filing/furnishing:
    - ☐ contained in the international application as filed.
    - ☐ filed together with the international application in computer readable form.
    - ☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

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**Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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1. Statement

Novelty (N)	Yes: Claims	1-19
	No: Claims	
Inventive step (IS)	Yes: Claims	1-19
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-19
	No: Claims	

2. Citations and explanations

**see separate sheet**

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**Box No. VI Certain documents cited**

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1. Certain published documents (Rules 43*bis*.1 and 70.10)

and /or

2. Non-written disclosures (Rules 43*bis*.1 and 70.9)

**see form 210**

**Re Item V.**

- 1 Reference is made to the following documents:

D1 : WO 99/44736 A (INSTITUT FUER MIKROTECHNIK MAINZ GMBH;  
EHRFELD, WOLFGANG; LOEWE, HOLGE) 10 September 1999 (1999-09-10)  
D2 : US 4 292 409 A (CREMONESI ET AL) 29 September 1981 (1981-09-29)  
D3 : US 4 863 567 A (RALEY ET AL) 5 September 1989 (1989-09-05)  
D4 : US 4 731 159 A (PORTER ET AL) 15 March 1988 (1988-03-15)

- 2 Document D1, which is considered to represent the most relevant state of the art, discloses (the references in parentheses applying to this document) a fluid contactor also called a microreactor comprising a substantially planar element wherein two channels are inserted. Said both channels have the form of a spiral with its axis centred onto the axis of said element. The fluids flowing respectively into the two channels separately meet and mix in a region in the proximity of the axis (see figure 1a).

The microreactor further provides inlet and outlet ports for introducing and recovering the fluids.

From this, the subject-matter of independent claim 1 differs in that the fluid-contactor of claim 1 of the present application comprises only one channel extending in a spiral, and that it further provides a rotation means for rotating the element.

- 2.1 The subject-matter of claim 1 is therefore novel (Article 33(2) PCT)  
The problem to be solved by the present invention may be regarded as to provide an alternative to the fluid contactors known from the available prior art.
- 2.2 The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons:  
None of the other documents cited in the international search report discloses an element providing a spiral-shaped channel and rotation means for rotating said element.

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In D2, which discloses a flow reactor for enzyme reactions, the channel is fixed, the enzyme is immobilized onto a matrix and the reaction solution is introduced into the spiral channel.

D3 discloses a distillation apparatus wherein the heat exchanger block provides an element comprising two intertwined spiral channels. If said heat exchanger block can be rotated horizontally onto its own axis, there is no hint given in this document to use such a rotation means with the fluid contactor of D1. Since two different technical fields are concerned, namely the distillation and chemical reactions in microreactors, it appears to be difficult to combine the teaching of this both documents together.

D4 discloses an evaporator comprising a discs assembly, whereby said discs may provide spiral channels on one of their face for disrupting the liquid film on said surface. There is also no mention of a rotation means.

- 2.3 Claims 2-17 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.
3. The subject-matter of claim 18 concerns the method of producing a fluid-contactor (according to claim 1) and fulfills for the same reasons as mentioned above the requirements of Article 33 PCT.
4. Despite of the lack of clarity of the subject-matter of claim 19 of the present application (see commentary below), it is clear from the description that what is intended to be protected is a method of producing a substance which is obtained by absorption or distillation with the apparatus of claim 1, in which the element comprising the channel and the fluids which react or are distilled is rotated at a sufficient angular velocity so as to move the second fluid which is more dense than the first fluid towards the aperture distant from the axis of the spiral. Since none of the documents describe or suggest such a concept, this method should be seen as novel and inventive.

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5. Article 6 PCT:

The present application does not fulfill the requirements of Article 6 PCT because some of the claims are not clear:

- 5.1. claim 1: this claim is directed to a fluid-contactor i.e. an apparatus claim. However, said claim contains some features ("...at an angular velocity sufficient to...") merely concerning a result to be achieved and relating to a method of using the apparatus, rather than clearly defining the apparatus in terms of its technical features. The intended limitations are therefore not clear from this claim, contrary to the requirements of Article 6 PCT. It appears to be necessary to introduce the presence of rotation means. Care should be taken not to extend the subject-matter of the application as originally filed (Article 19(2) PCT)

It is also pointed out that the density of the fluids involved are not features of the apparatus itself. Then, they are relatively unnecessary in present claim 1 and should be deleted (Article 6 PCT, conciseness of the claims).

- 5.2. Present claim 9 is not allowable as such since it is dependent on claim 1 and should consequently contain apparatus features, but this claim only contains features relating to the properties of the fluids involved during the use of the apparatus. The content of this claim is consequently not clear.
- 5.3. Present claim 19 is directed to a method of producing a substance; however, the only features present in this claim are to provide a fluid-contactor (according to claim 1) and to rotate it to move the second fluid within the channel towards the second aperture. It is for the reader not possible to know how a substance can be produced with the steps given in this claim. A clarification is necessary since it seems to be difficult to carry out said method (Article 6 PCT, lack of essential features).